A WORD FROM THE DEAN
Professor Anton le Roex
Dean of Science

The Faculty of Science has a long and distinguished history. Formally established in 1918 by UCT’s founding act, today it is a sizeable faculty of 12 departments and multiple research units, whose teaching and research is internationally acknowledged for excellence.

To maintain this high standard, we aim to ensure our international standing and visibility, and also extend our international links. These academic units are engaged in a variety of activities and international collaborations that impact areas that will enable us to provide a wider range of teaching and research opportunities. You can read about them in the graphic below.

The strategic focus also includes deepening ties with the US for two Nobel Prize winners (Aaron Klug and Allan Cormack, both from the Department of Physics), while today, some 40% of our academic staff are rated by the NRF as either international leaders or a small number of very highly rated outstanding young researchers with the potential to become world leaders (P-rated). With over 100 research masters and PhD students, the faculty also contributes 2% of the publication output of the university and over a third of the university’s annual PhD graduates. There is much to be proud of.

The Greater Cape Floristic Region includes two Mediterranean biomes; fynbos (which includes renosterveld) and the succulent karoo. The succulent karoo biome is the world’s greatest arid region, which supports the greatest biodiversity on the continent.

The astronomical landscape in South Africa has changed dramatically over the years. The Department of Astronomy is compiling a 2015 calendar featuring images taken through the telescope.

The telescope is already being used to teach astronomical techniques to second-year students and optical photometry to third-year stellar astrophysics students. Other instruments on the campus include the Low Energy Cathode Ray Tube and the Knobloch Optical Interferometer.

The Observatory runs under the direction of Professor Claude Carignan and Associate Professor Patrick Woudt.

The major global medical need of the 21st century is to prevent and treat cancer. To this end, the UCT Cancer Centre has been established to provide an umbrella for all cancer-related research and teaching activities throughout the University. It is also home to more than 14 500 type specimens (specimens used to describe a species for the first time in science and to assign it to another classification) of birds, reptiles, and a range of bird species in order to improve understanding of the geological history of the region.

The UCT Cancer Research Institute houses one of Africa’s most advanced electron microprobes, the Jeol Superprobe JXA-8100, which is used to analyse the composition of bone and teeth, and to investigate the longevity of ancient interactions.

The Department of Chemistry is renowned for its research in inorganic, physical, and analytical chemistry. It is the largest department in the Faculty of Science and has a rich history of excellence in research and teaching.

The Department of Biological Sciences is renowned for its research in plant systematics, taxonomy, and conservation. It is one of the oldest and largest departments in the world and has a dedicated herbarium, the Bolus Herbarium, which houses more than 350 000 specimens.

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Preview: African science

Do local scientists have capability to shape the course of knowledge? How can we encourage them to engage in science to address local issues? These are issues that Professor David Gammon addresses in his book about the growth of the next generation of scientists in science.

"Science is universal," says Dean of the Faculty of Science Professor Anton le Roex. "So it's not about the value of African-centred science for its own sake, but how to apply it so that we can impact the lives of people who live on the continent, but also beyond it. The challenges that we have in our immediate environments, like climate change, disease, and poverty, are common to everyone in the world, and we need to address them together.

GROWING YOUNG SCIENTISTS

Compiled by Yusuf Omar

UCT's top scientists are recognised globally for their work, but Associate Professor David Gammon recognises that grooming the next generation is just as important to keeping the Faculty of Science in shape.

For the second year running, the winter school has been a week in July sharing the wealth of UCT's scientific knowledge and expertise. "It has been a wonderful experience to see the impact that our students have had in working with the students," says Gammon. "They have been able to engage with the students and share their knowledge in a way that is meaningful to them."

One student said of the winter school: "I sense a shift in my consciousness. It is as if my world has opened up in a way that I didn't think was possible before. It has made me realise that I can make a difference in the world and that my work has value beyond my own day-to-day life.

For the sake of future generations

The principle of intergenerational equity is that we have an obligation to use the resources of the current generation to support the needs of future generations. This means that we need to take into account the impact of our actions on those who will live after us.

"The idea is to help students to understand the importance of science and to inspire them to pursue a career in it. Science can be a powerful tool for addressing the challenges that we face in our society and in the world. By working with local scientists and institutions, we can encourage the next generation to become scientists and contribute to the global knowledge economy.

One student said of the winter school: "I have a new appreciation for the importance of science and how it can be used to solve real-world problems. I have also come to realise how much we depend on science in our daily lives and how much we stand to gain by investing in education for the future.
NEW FRONTIERS, NEW ADVENTURES

“Discovers in science... will continue to create a thousand new frontiers for those who would still adventure.” said former US president Herbert Clark Hoover. Helen Swingler asked a handful of UCT researchers to speak about their adventures at the outer limits of science.

“Second, and related, is the need for new paradigms of thinking, drawing on – among others – complexity science and transdisciplinary methodologies. We need to bring together expertise from both the natural and physical sciences, with other disciplines such as law, economics, humanities, health, on an equal footing.”

Climate scientist Prof Kevin Naidoo

“Within our current understanding of quantum physics, even though we understand a great deal of how it works, there are many experiments and research directions in this area that could be explored. These experiments could lead to new insights, understanding and technological applications. For example, quantum computing is a field that is rapidly advancing and has the potential to revolutionize many areas of science and technology.”

Cosmologist and Distinguished Emeritus Professor George Ellis

“Take quarks, for example. Rather than being given a name defined from the Latin concepts, the subatomic particles are actually given names that are descriptive of their properties. James Joyce coined the name ‘quark’ to mean a strange, strutting, top-hatting, horned animal under the rules of the Western Cape Comedy Club in Cape Town’s age. It is closely related to the larking Cape Dormouse.”

Chemist Professor Kelly Chibale

“Some animal names have been assigned bashfully to humans in a miasma of confusion relating to the human genome. For example, the species name for a giant cell was actually given to a giant cell found in the human body. This led to much confusion.”

Animals were described in a 1985 paper by Dr Robin Griffiths of the University of Massachusetts Amherst, and likewise, the name ‘Scotophilus mhlanganii’ for a yellow-bellied bat in the iSimangaliso Wetland Park was named after the owner of the research project, the author’s grandfather. Also, the scientific name for a golden mole species was changed after a family holiday in the area led to his father noticing and collecting the golden mole in the field. This led to the name ‘Chrysochloris bronneri’ being given to the species.”

Professor Frank Shillington

“Dr Gary Bronner is a more visible example of a somewhat liberal scientific naming convention. As a field ranger Jacques van Rooi once requested for a loo stop during a family holiday in the area led to his father noticing and collecting the golden mole in the field. This led to the name ‘Chrysochloris bronneri’ being given to the species.”

Systematist and Distinguished Emeritus Professor Dr Gary Bronner

“We tend to believe what we can see and touch. Yet in many fields, such as chemistry, our knowledge is deliberately biased by what we indirectly measure with physical instruments.”

Prof Mark Reeves
Ongoing research, documentation, and citizen science projects make it possible for observations made by many different people to be pooled and analyzed as a whole, the authors report in their introduction. “This provides the basis for understanding population trends in species of which we have very limited knowledge.”

The relationship of mobility is reflected in the fact that farm donkeys pull their owners on roads or tracks through the shrubland, often accompanied by their owners’ domestic flocks and occasionally by other donkeys. The relationship is well captured in the fact that farm donkeys do not pull their owners in open landscapes, on tracts or tracks that lack a definite structural form. Donkeys are especially equipped for this relationship and are thus employed in the process of creating and maintaining landscapes on a scale large enough to cause a substantial degree of impact.

The new NRI has modelled the kind of detailed research on mining operations on the side, and related environmental knowledge. This is because cumulative environmental impacts for the kind of mining that mining in this area, principally, is based on data collected and compiled by local people and volunteers to provide local knowledge and culture.

Industrial agriculture produces a large amount of waste and knowledge, and is leading to the creation of industrial-scale monocultures. These monocultures are in turn converted into recreation spaces and commercial leisure for tourists. The NRI is now focusing on the Namaqua Dune Landscape. An effort is being made in this area to develop a highly accessible and sustainable tourism, that also can be enjoyed by local communities.

In Namaqualand the new NRI has now broadened its restoration activities to include communities. The NRI is working with communities, and national and regional partners, so that smallholder farmers – women in particular – have more control over seed procurement and distribution.

“The first priority of the project is to help communities and farmers revive traditional seed and agroecological knowledge systems,” says Woywod. “Farmers exchange has formed horizontal learning and knowledge exchanges between communities, and across communities. What we are doing is also taking place in formal seed systems such as gene banks and conservation of rare and endangered plant species.”

Ongoing research, documentation, and experimental learning are still at the proofs of the new paradigm of policy-making in science. Traditionally, farming, small-scale food-producing systems, and agroecological systems are part of a complex socio-ecological system in farming communities throughout Southern Africa. “We need to bridge the gap between community resilience and policies,” says Hofmeyr.

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Big data – large and complex data sets that are difficult to process using traditional computer hardware – is a popular term that has gained ground in the last decade, not only in everyday life, but also in research. UCT is taking the lead in creating the framework to allow African researchers to get to grips with the increasing volume, velocity and variety of data, and turn it into actionable knowledge.

The modern world is steeped in a data deluge. “The data flow is so that the total accumulation of the past ten years – a century – dwarfs the joint output of human civilizations,” wrote Nestor售后商学院’s Mark B. 2014. No minority least of all researchers, who now work with large data sets that are increasing exponentially in size, can navigate this flood alone. While data-intensive research can cross the disciplines — including engineering computer science and artificial intelligence, economics and finance — the avalanche frequently finds those at the beginning of their careers holding the water to those at the beginning of their careers.

In 2008, Cutter Isb., leading a research and advisory company called Cutter Strategic Intelligence, identified “large and complex data sets that require cost-effective, innovative forms of information processing for enhanced insight and decision-making”.

The Cape Mountain Club has an extensive photographic collection, including hundreds of African views. Many of the photographs were taken from the grounds of the Broadfield Observatory, Pretoria, in 1969, using a 12½-inch telescope, and signed by American astronaut Neil Armstrong, the first moonwalker.

The scope of the digital revolution is best understood through the lens of the LHC. The LHC is the world’s largest and most complex scientific instrument. It is a machine that produces the conditions of extremely high energy to recreate the conditions of the early universe. The data from the LHC are generated through three types of experiments: solid state, liquid state and plasma state.

One of Africorim CEO Louisa Ludlam’s key principles — the data-led approach with the day-to-day managers that need her direction. Ludlam was encouraged to be an early age to read widely, and was given a copy of the work, a few major research questions, particularly focusing on the role of the immune system. Whenever the family valued their extensive collection of African art, such as Professor F. Swann, for special instruction.

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Dr Francis Thacker’s photographs of Table Mountain (Slang of the Tafelberg) including the Africa Rock Paintings of South Africa and a research ship named after the former UCT principal and one of several research vessels the university has owned over the years. It is part of the TB Davie collection, which includes cruise reports, asset registers, charter of the vessel and records gathered between 1954 and 1994.

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A photograph of Villeneuve, a small bird found in the high-desert fringe of the Altiplano, Chile, taken in 1839. The bird is a member of the family of wintering to the Americas. The Cape Mountain Club has a comprehensive collection of photographs, including images of natural history, natural resources, and natural history, captured between 1934 and 1994.

A cartwheel model of a bird and a bed nestling to the wing of a hummingbird. The model includes unit coordinates,orian, and materials. The photograph, taken in 1839, belongs to the Smithsonian Institution's National Museum of National History, and is the result of a scientific expedition to the Americas. The Cape Mountain Club has a comprehensive collection of photographs, including images of natural history, natural resources, and natural history, captured between 1934 and 1994.

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If you had to take away one life lesson from the sciences – one small fact that could expand your world – what would it be? We asked young scientists at UCT what they’ve learnt from their subject – and what others stand to learn.

**Samantha Julius**
Chemistry

> Everything that exists in this world is made from just a few different atoms. It is so intricately connected that a single atom missing or out of place determines the difference between a disease or a perfume. Everything that is, exists for a purpose.

**James Pelsor**
Genetics and microbiology

> To the average person on the street, science is daunting – often seen as more difficult than it actually is. However, it is only with science that we have advanced this far, and only with it can we advance further.

**Morema Moloisi**
Astrophysics

> I would like people to know about the sun. The first thing I’d like to tell them is that the sun is also a star, just like all the other stars which you see in the night sky. The only difference is that it’s the star in our solar system, and it’s closer to us than all the other stars, which are much, much further away. The second thing is that the sun is not really yellow, because it’s emitting white light. It’s actually a white star. It’s just that our atmosphere refracts the light from the sun and makes it look yellow.

**Simeon Brown**
Biochemistry and genetics

> I think that people shouldn’t just swallow everything they see or hear from people or the media. Make your own opinions. Form your own conclusion. Think about it for yourself. By just swallowing everything whole, you’ll just get fat from the force-feeding of information. Think for yourself. The world is more interesting with your mind in it.

**Candice Koopowitz**
Archaeology

> Archaeologists look to tell the story of how we came about and the different paths that were taken by our ancestors to get to where we are today. It provides people with an understanding and sense of equality and belonging in that we’re all humans, evolved from the same ancestors, who overcame the same problems.

**Simeon le Roux**
Biochemistry and human physiology

> Studying the human body and how it works, you realise how amazing your body is and how much it does for you. It really is the least you can do to take care of your body. It’s much easier to stay healthy than it is to get healthy again. You shouldn’t wait until something goes wrong before you start looking after your body. I think it’s really important to educate yourself about what you need to be healthy. There are so many products out there that make frankly ridiculous health claims, and people waste money on them when there are way cheaper, way easier alternatives. Learn about what you need, read the labels on the products you buy, figure out for yourself if a product is really going to help you. There is so much information available now that there’s no excuse for being fooled by some fancy packaging.

**Dr Takalani Theka**
Chemistry

> According to the World Health Organisation, more than 70% of the world’s population uses traditional medicine. So it’s not surprising that scientists all over the world are involved in research on medicinal plants, trying to find out which chemicals in the plants have healing properties. Scientists then ‘make’ or synthesise the chemicals in the laboratory. A famous example would be the bark of the willow tree, which patients were traditionally advised to chew in order to cure pain and fever. Scientists studied this medicinal plant and later ‘made’ or synthesised aspirin. I study the chemical compounds in the essential oils obtained from medicinal plants that can be used in pharmaceuticals, cosmetics, perfumery and food products.